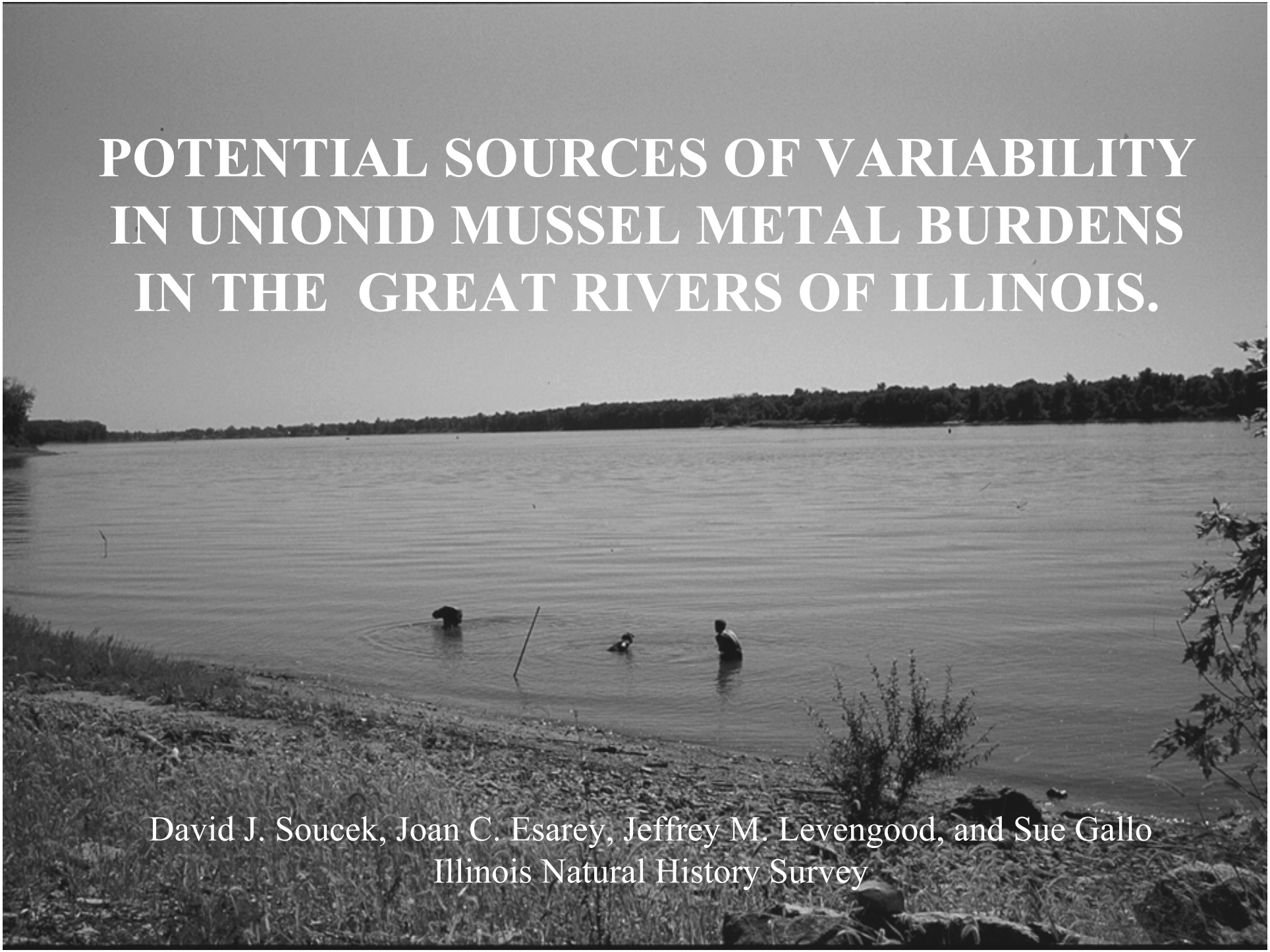
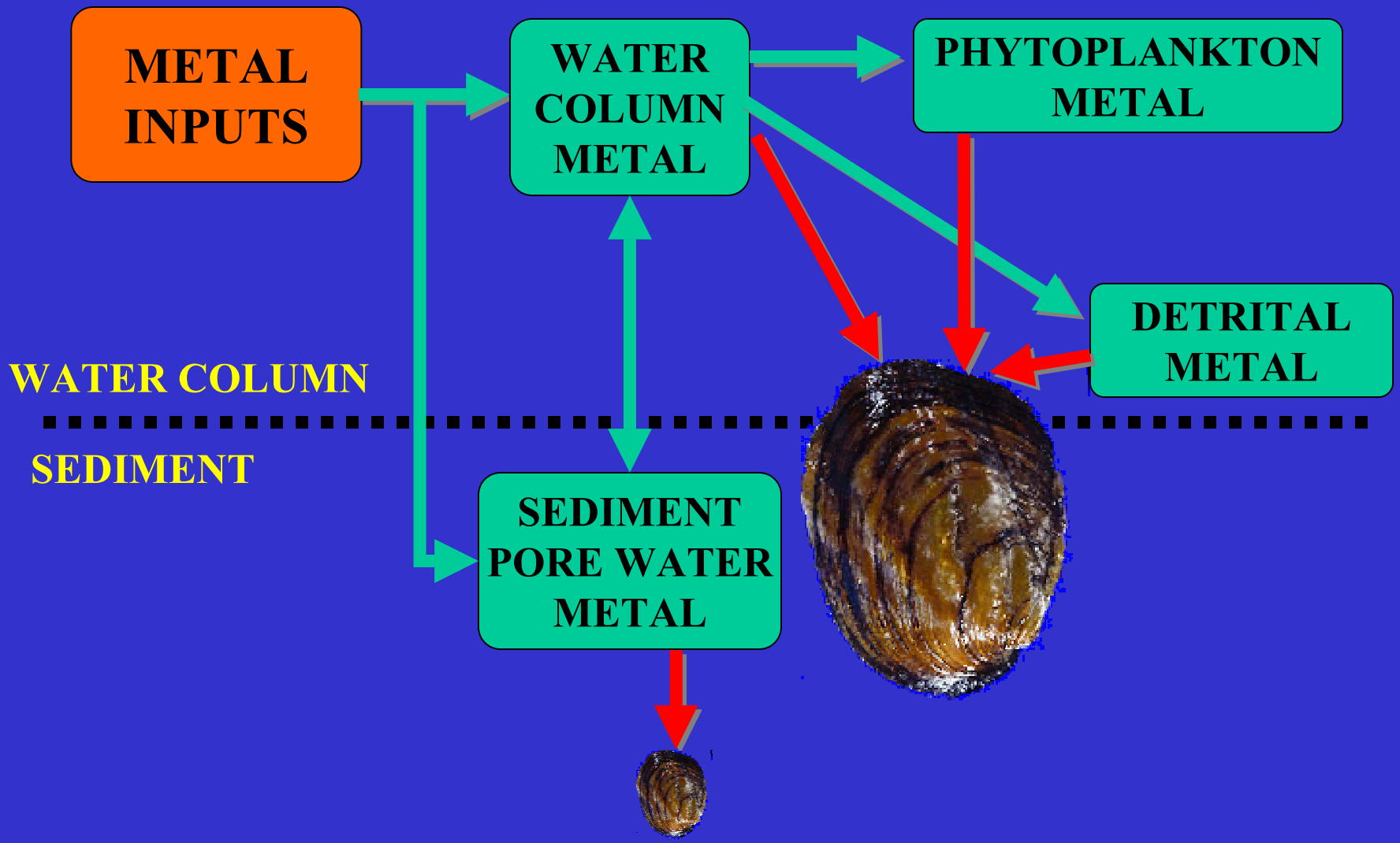
POTENTIAL SOURCES OF VARIABILITY IN UNIONID MUSSEL METAL BURDENS IN THE GREAT RIVERS OF ILLINOIS.



David J. Soucek, Joan C. Esarey, Jeffrey M. Levengood, and Sue Gallo
Illinois Natural History Survey

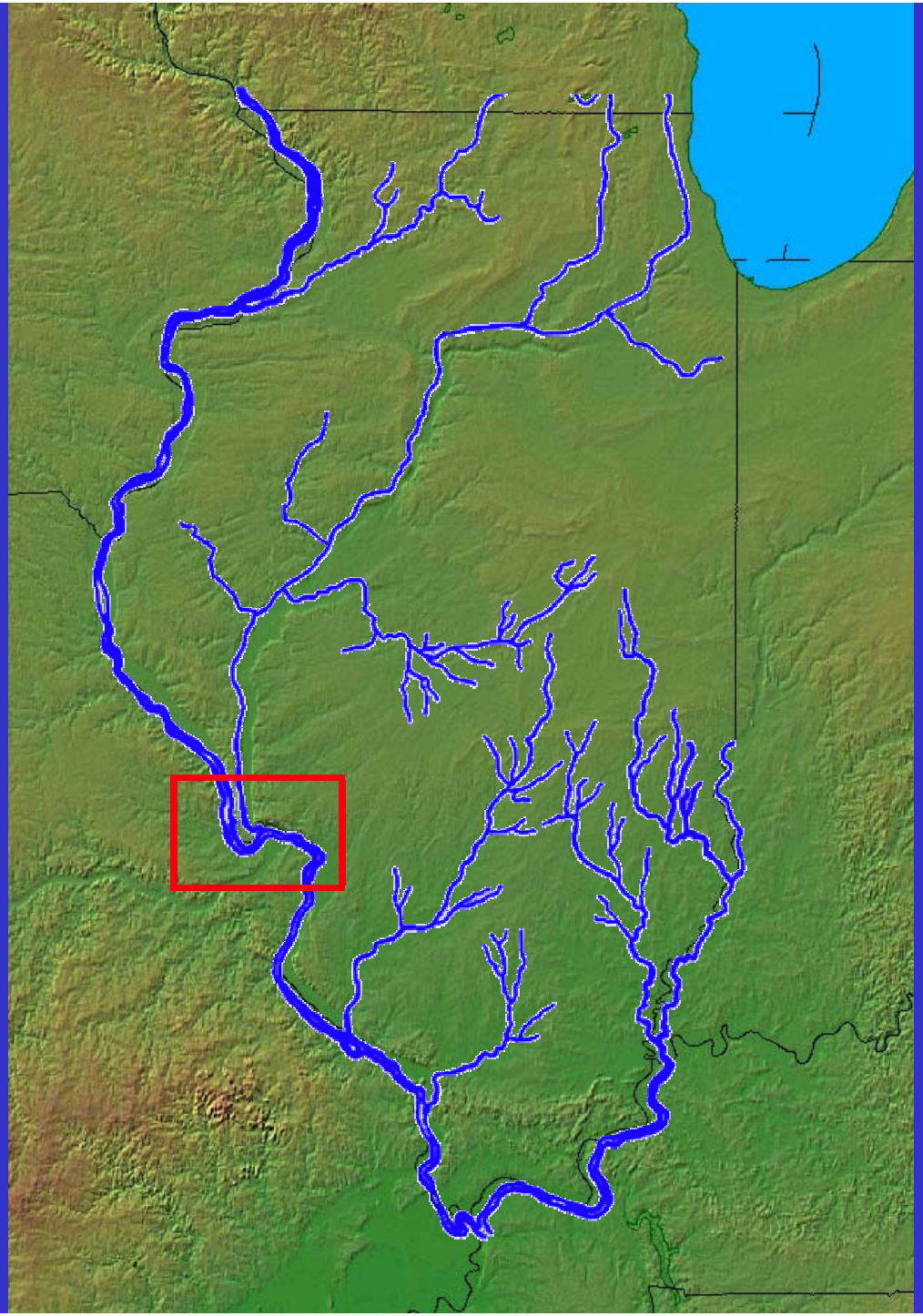
CONTAMINANT UPTAKE BY BIVALVES



Modification of Thomann et al. 1995.

Objectives

- Determine metal levels in mussels from the Mississippi & Illinois Rivers confluence area
- Assess spatial and interspecific variation in metal concentrations
- Assess risk to mussels and their consumers




ILLINOIS
MISSOURI
MSD (217)
IL (5.5)
MSU (233.5)
N
Jerseyville
ALTON
ST CHARLES
FLORISSANT
PORTAGE DES SIOUX
MISSOURI RIVER

Experimental Design

Spatial comparison: *Amblema plicata*

MS Upstream (MS) vs. IL vs. MS Downstream (MSD)

Species comparison MSD

A. plicata

Megalonaias nervosa

Quadrula quadrula

Cummings & Mayer 1992

Methods

Field

***Amblema plicata* at 3 sites**
n=10 at each site

2 additional species at MSD
n=5 of each species

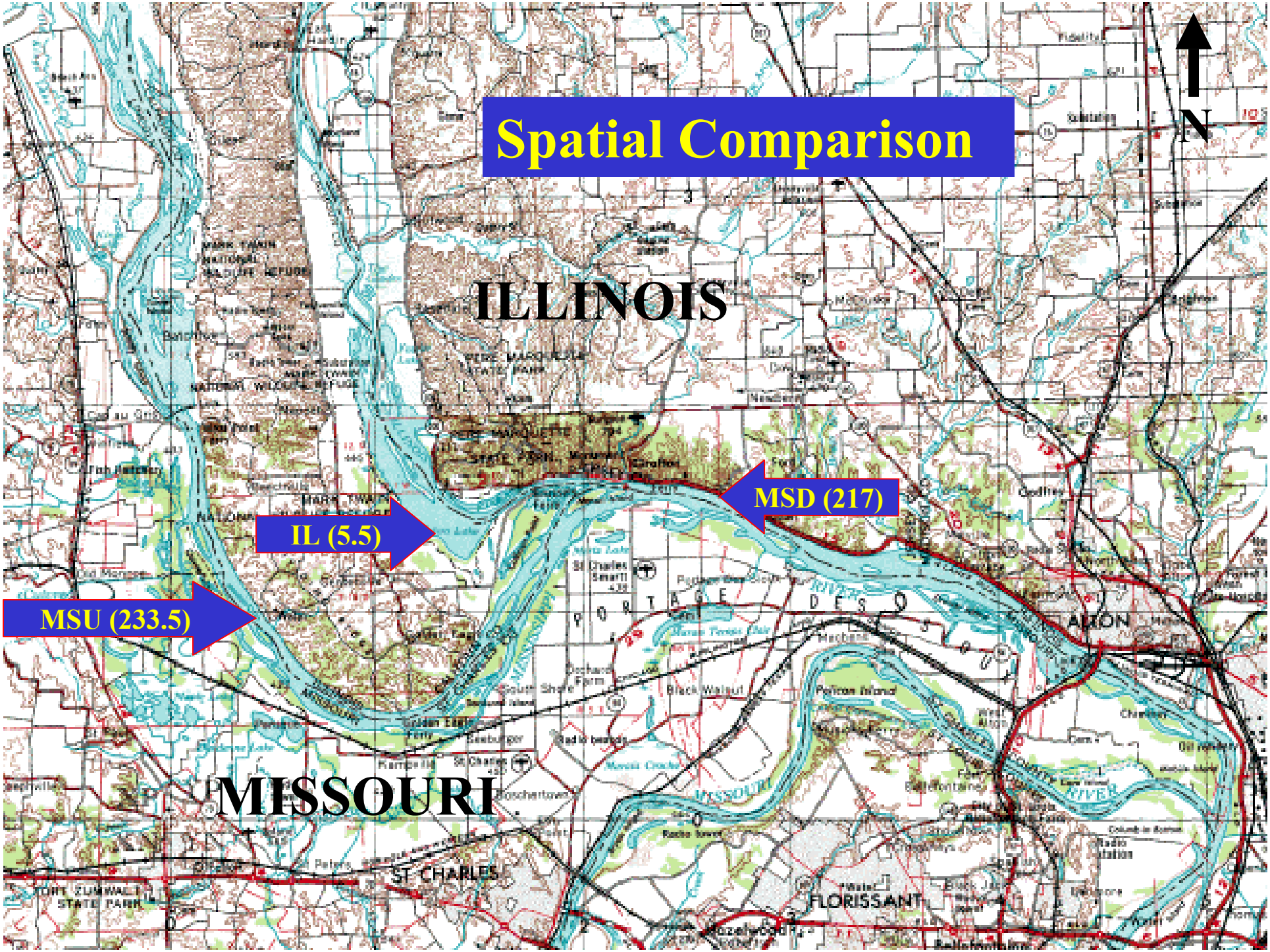
Laboratory

Measured shell length & height (age)

Removed and homogenized all wet tissue

Obtained tissue wet/dry tissue weights & shell dry weights

Tissue Condition Index = dry weight / shell weight


Spatial Comparison
ILLINOIS
MISSOURI
MSD (217)
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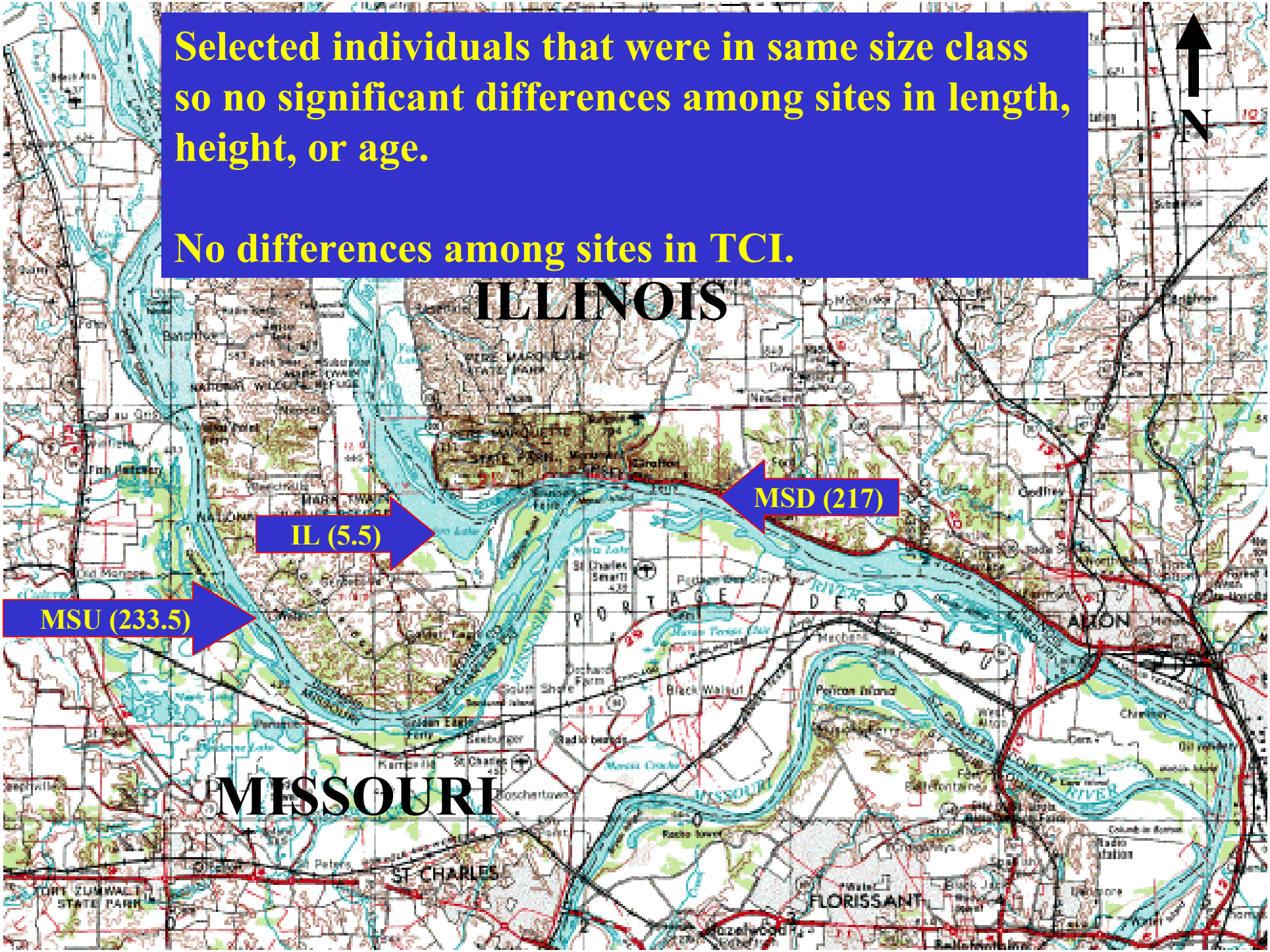
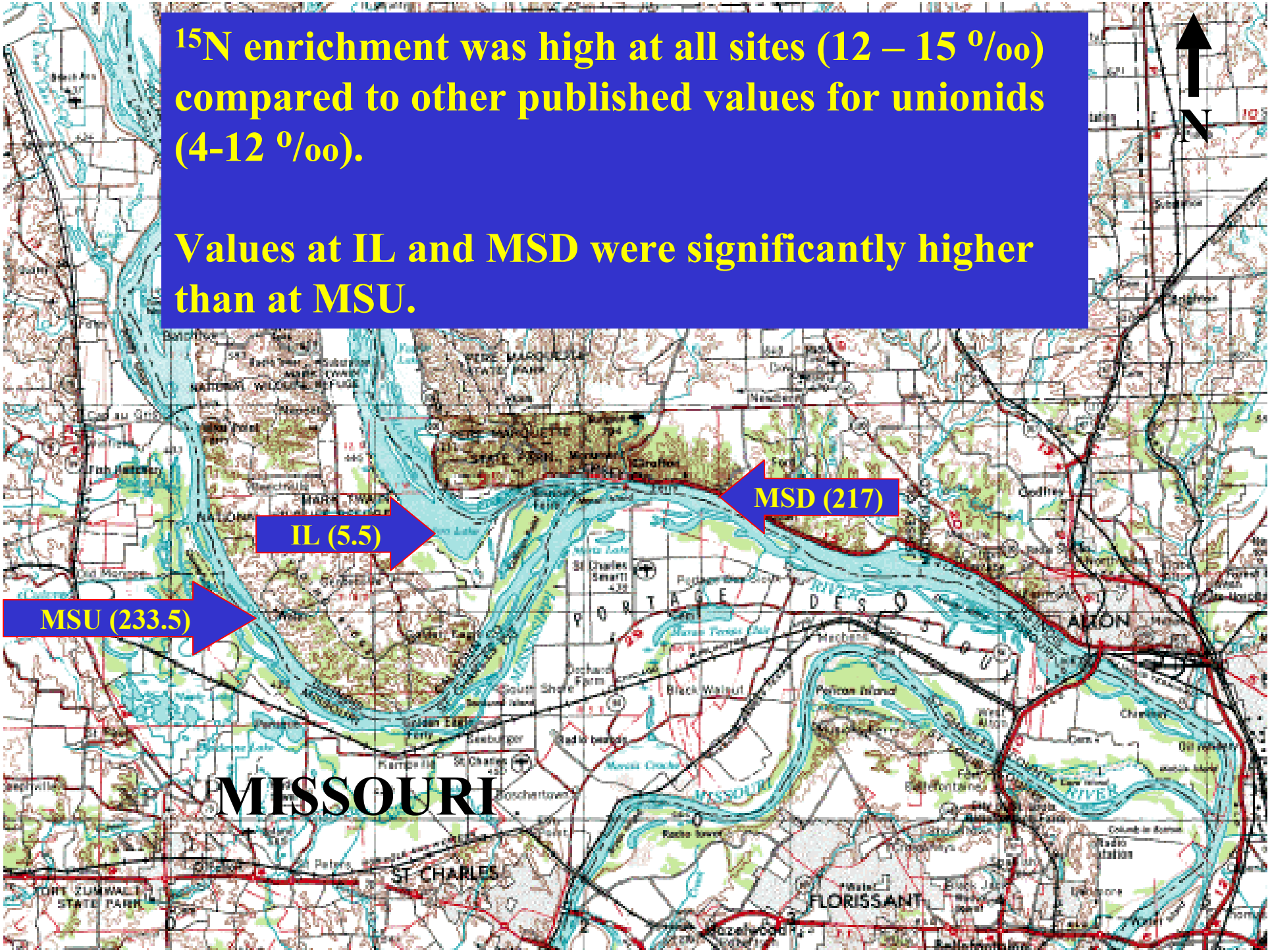
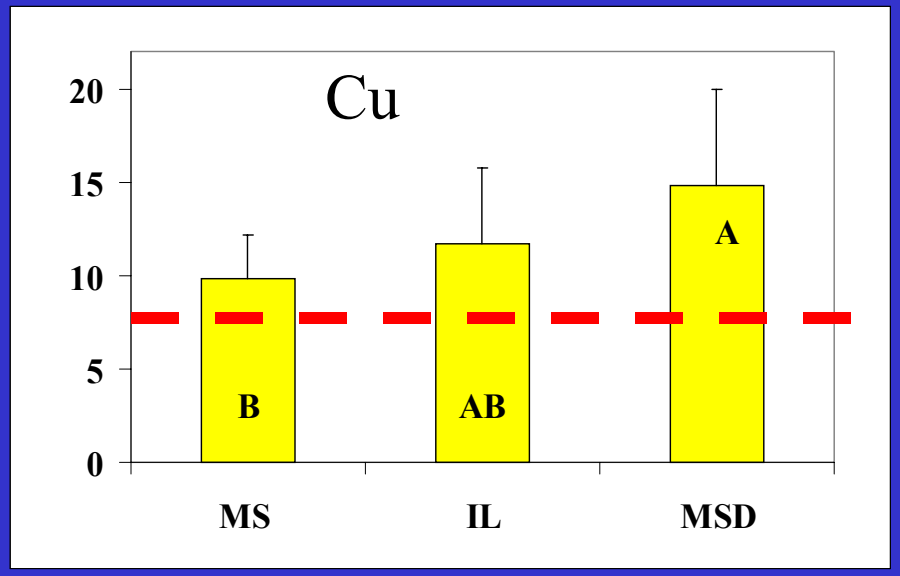
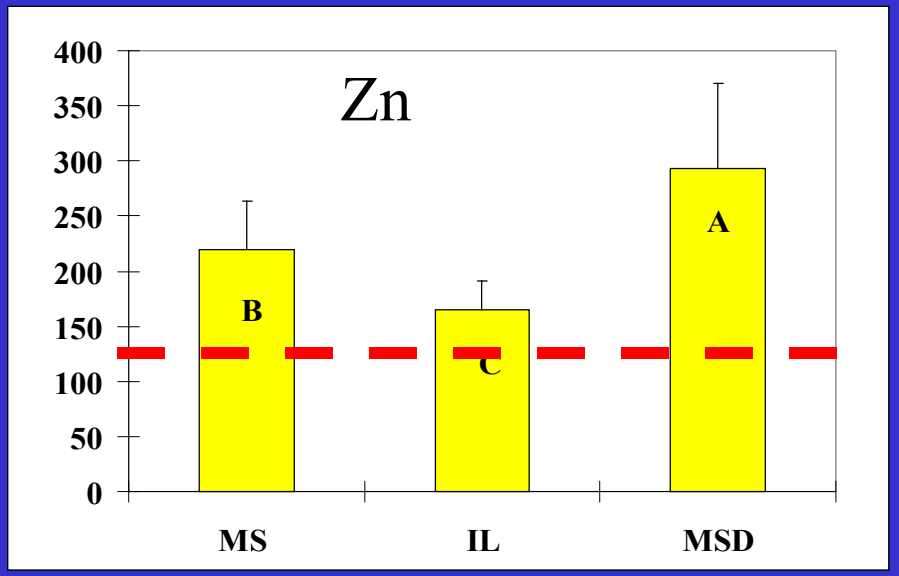
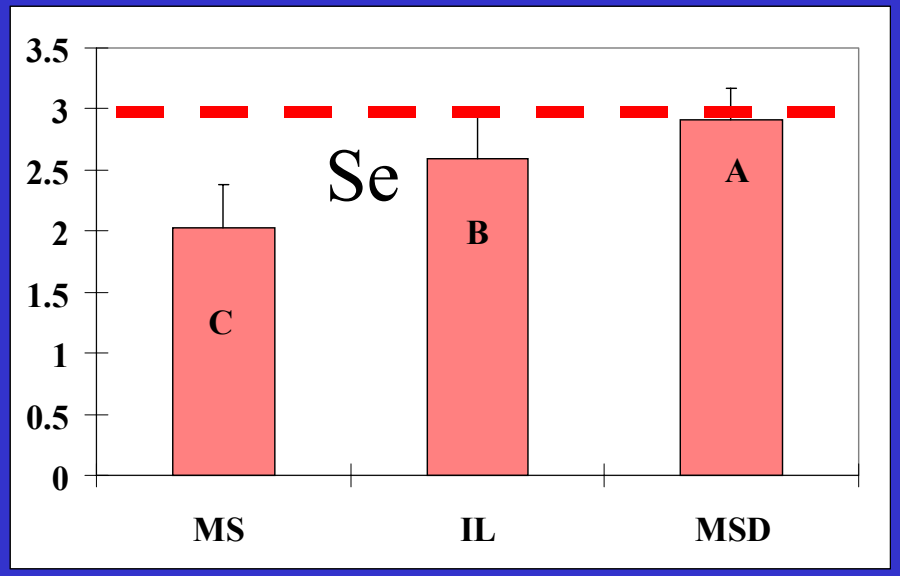

Selected individuals that were in same size class so no significant differences among sites in length, height, or age.
No differences among sites in TCI.
ILLINOIS
MISSOURI
MSD (217)
IL (5.5)
MSU (233.5)
N
ALTON
ST CHARLES
FLORISSANT

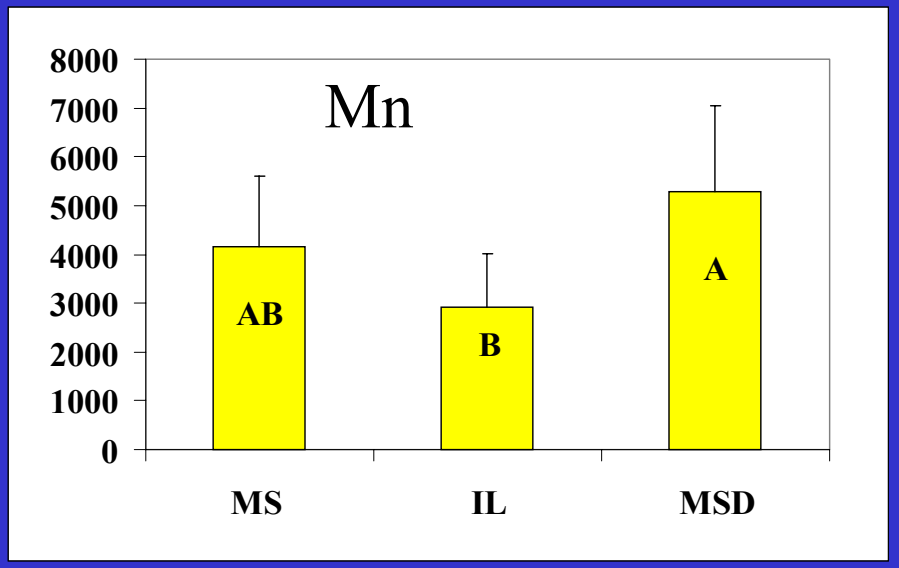

^{15}N enrichment was high at all sites (12 – 15 ‰) compared to other published values for unionids (4-12 ‰).
Values at IL and MSD were significantly higher than at MSU.
MSD (217)
IL (5.5)
MSU (233.5)
MISSOURI
ST CHARLES
FLORISSANT
ALTON
N

Spatial differences in *A. plicata* tissue metal concentrations (ppm dw)
Several metals highest at MSD

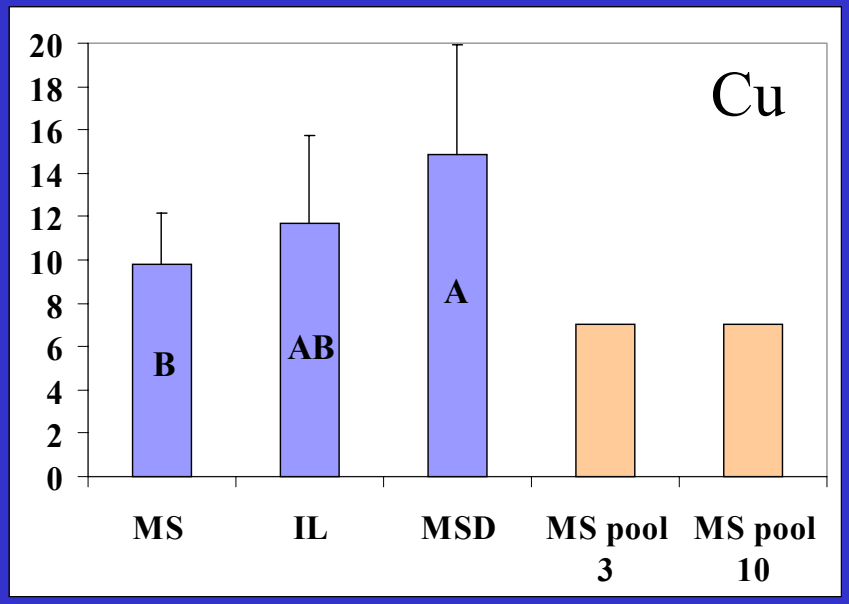


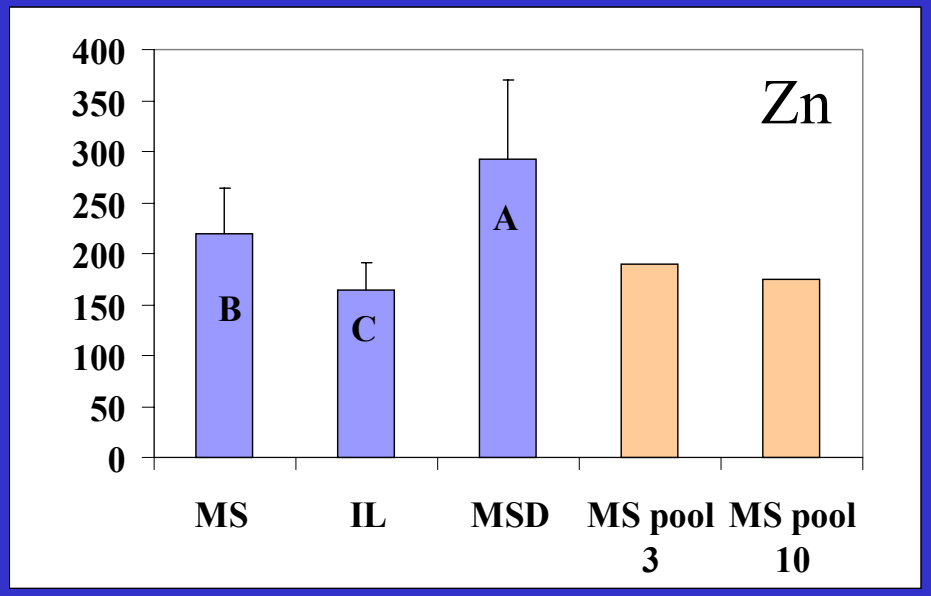


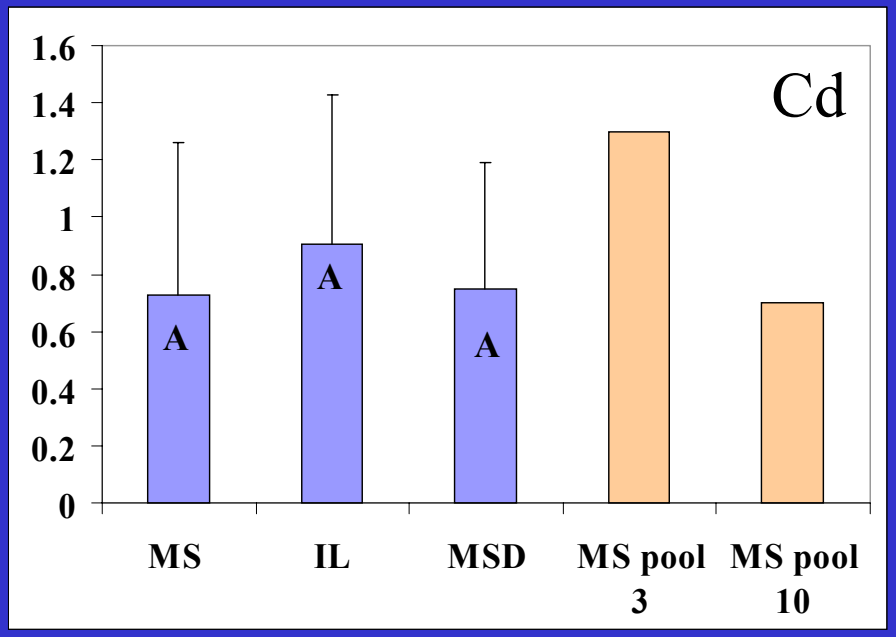




Spatial differences in tissue metal concentrations (ppm dw)
Comparison with T. J. Naimo (1992) *A. plicata* data (Pool 3 & 10)







Species Comparison at Mississippi River Downstream (MSD)

Amblema plicata

Megalonaias nervosa

Quadrula quadrula

Is a mussel a mussel?
(in terms of metal loads)

Species Comparison at Mississippi River Downstream (MSD)

Amblema plicata

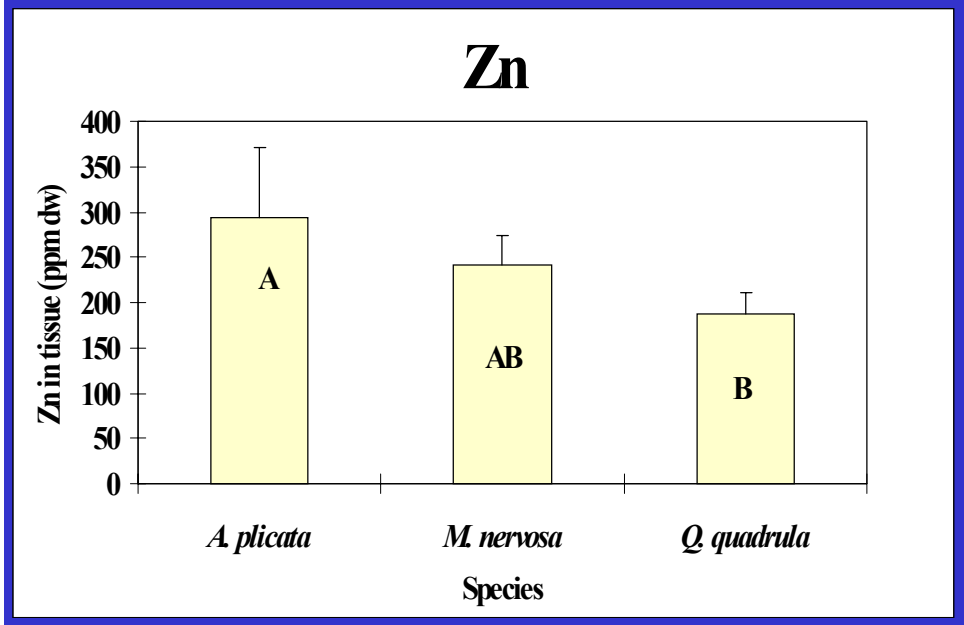
Megalonaias nervosa

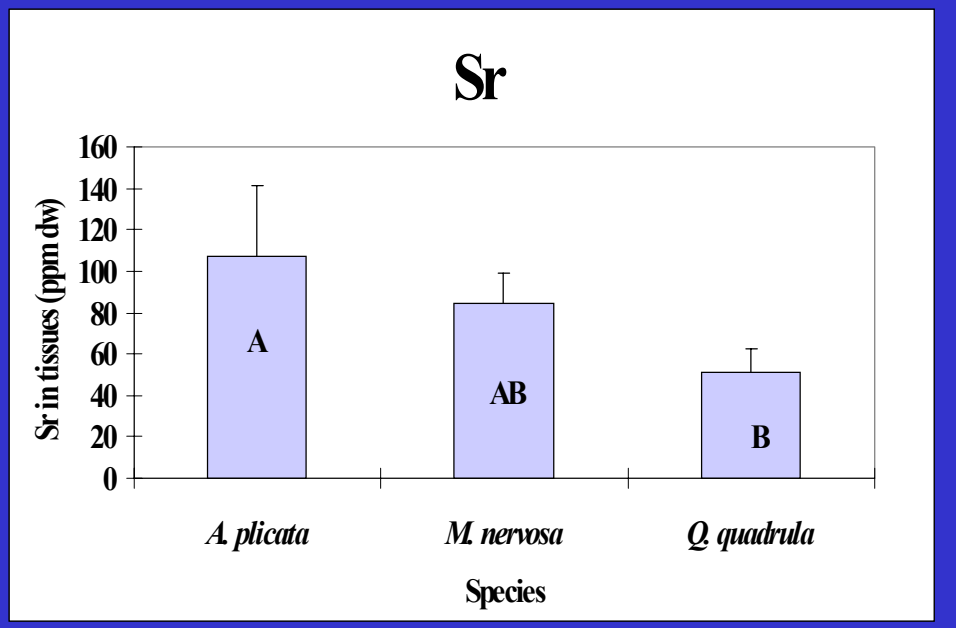
Quadrula quadrula

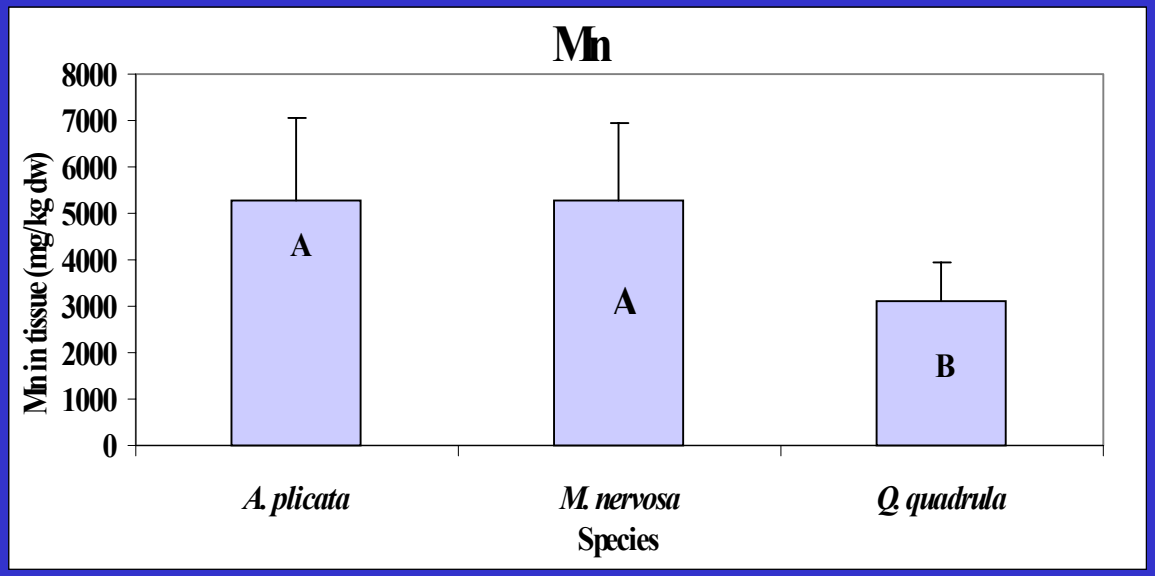
Is a mussel a mussel?
(in terms of metal loads)

For some metals
(e.g., Cd, Cu, Ni)
yes….

Interspecific variation at MSD







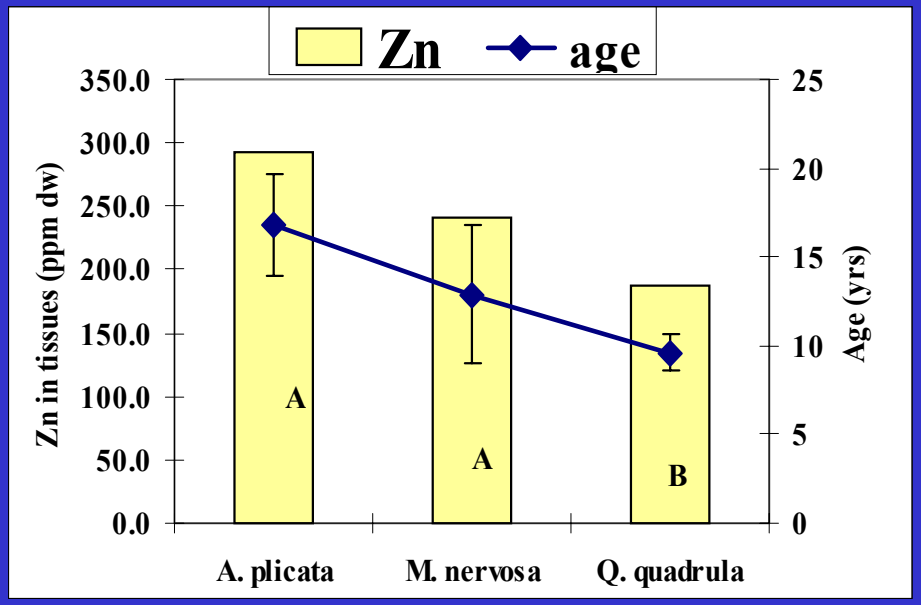
Potential Explanations for Interspecific Variation in Metal Concentrations

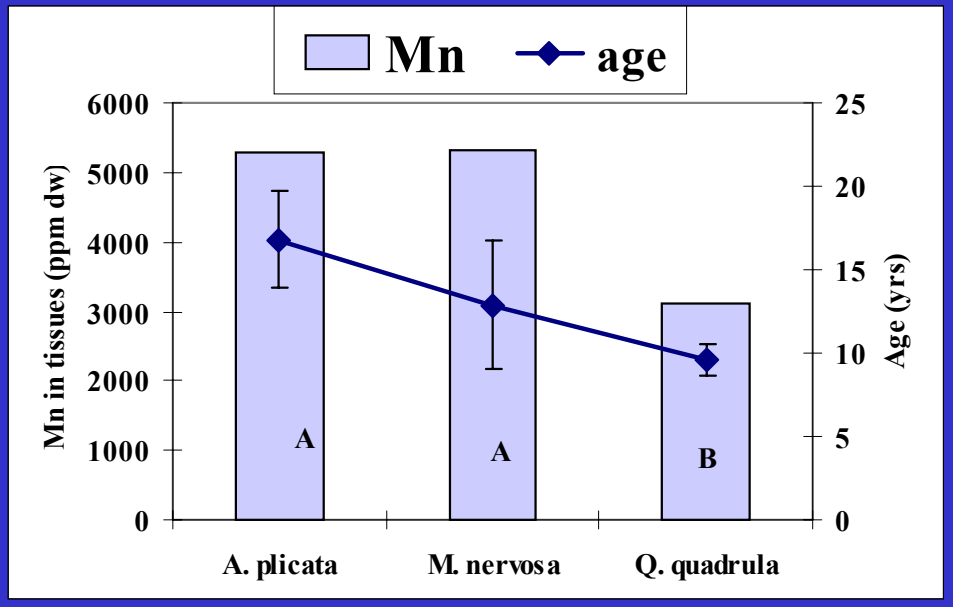
- Differences in ages
  - Longer time to accumulate metals?
  - Younger species present under lower contamination levels than previously present?

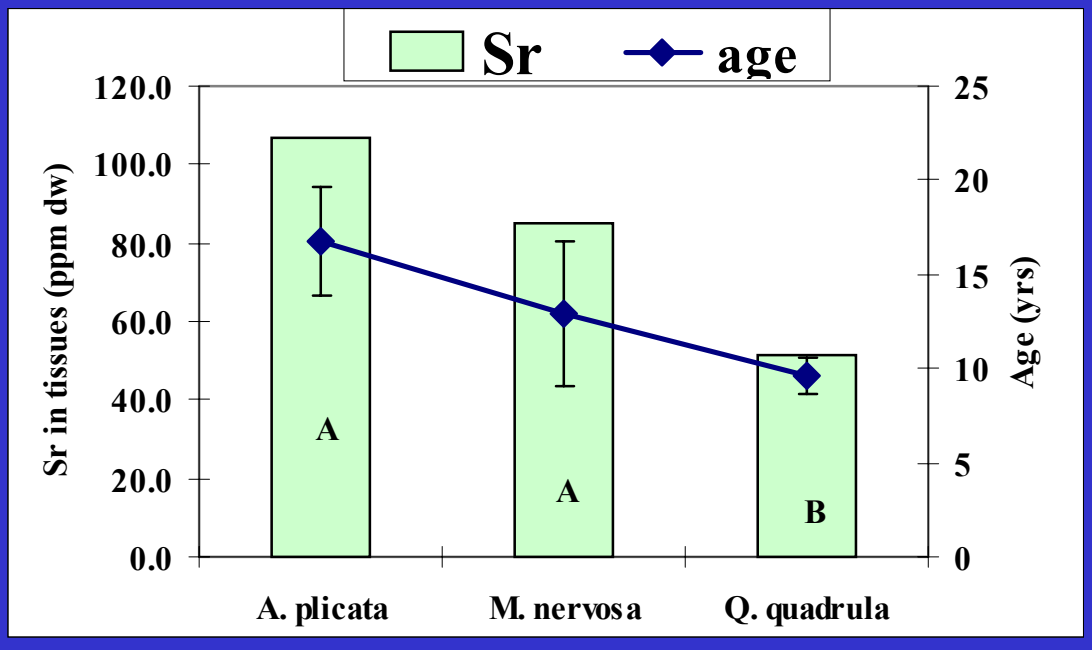
- Differences in feeding
  - Different filtering rates and/or food selection (because of gill morphology)
  - Different assimilation, depuration rates

Differences in Age

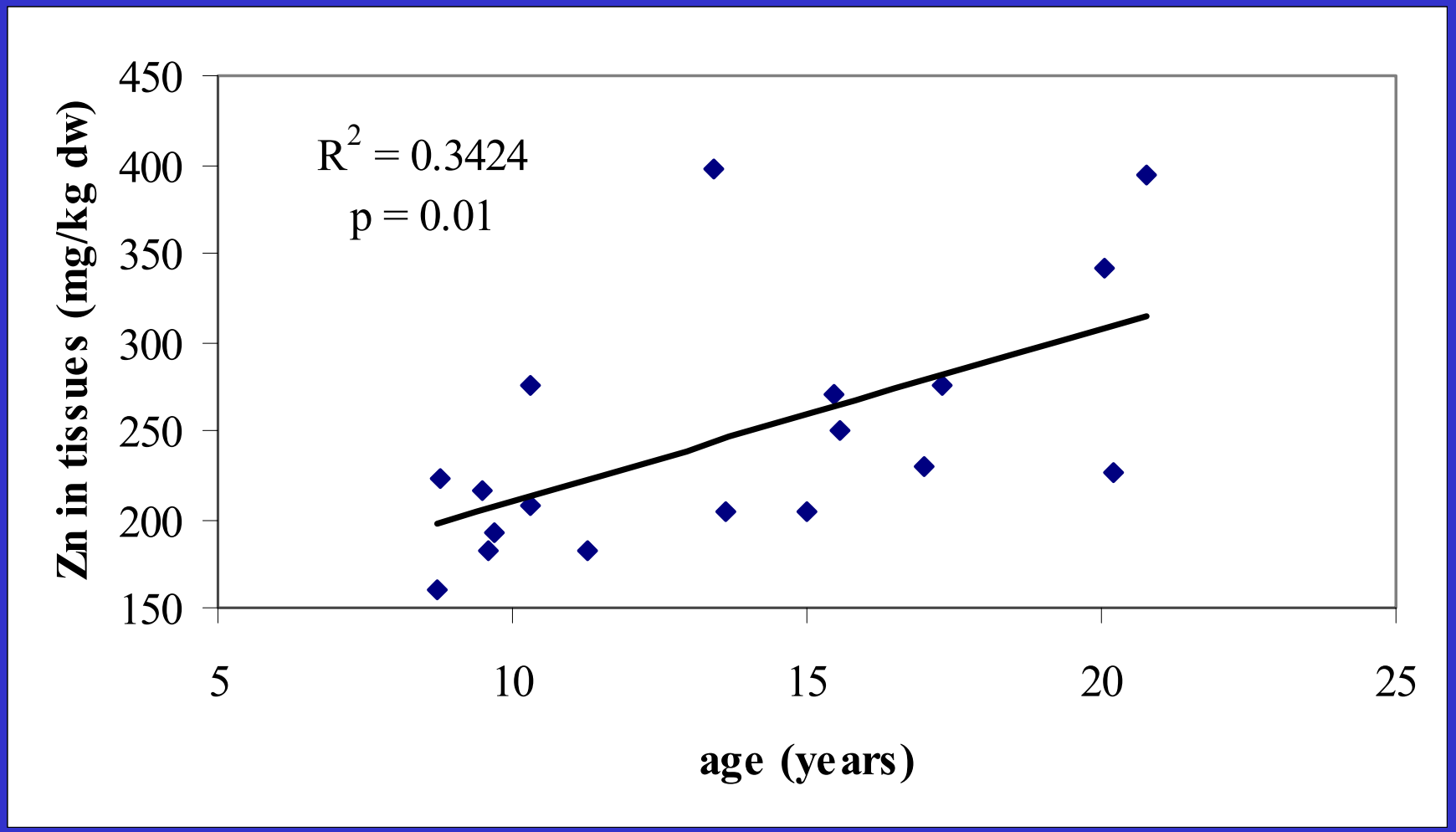
Interspecific variation at MSD





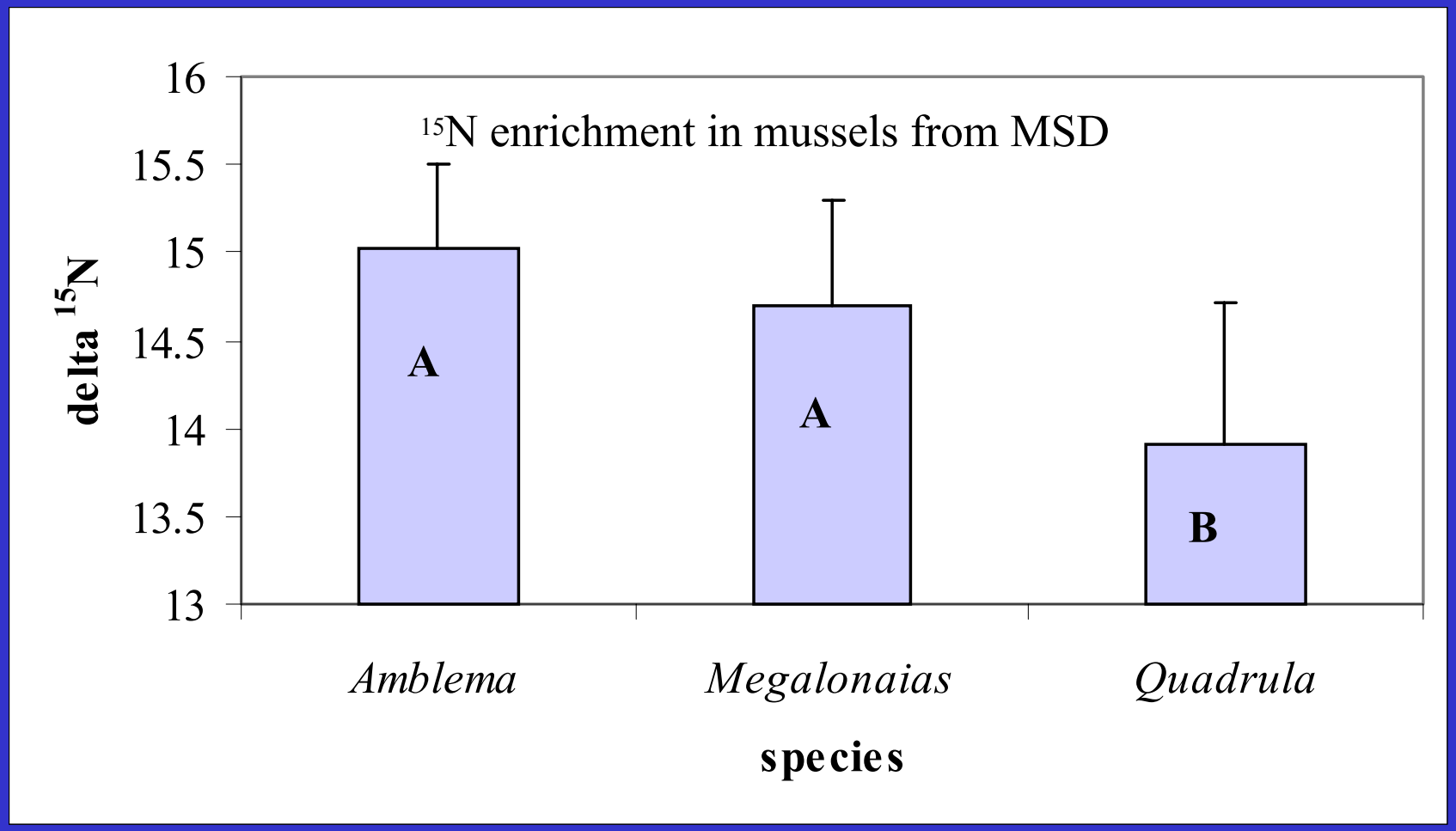


MSD
Zn vs. Age (all three species)



Differences in Feeding

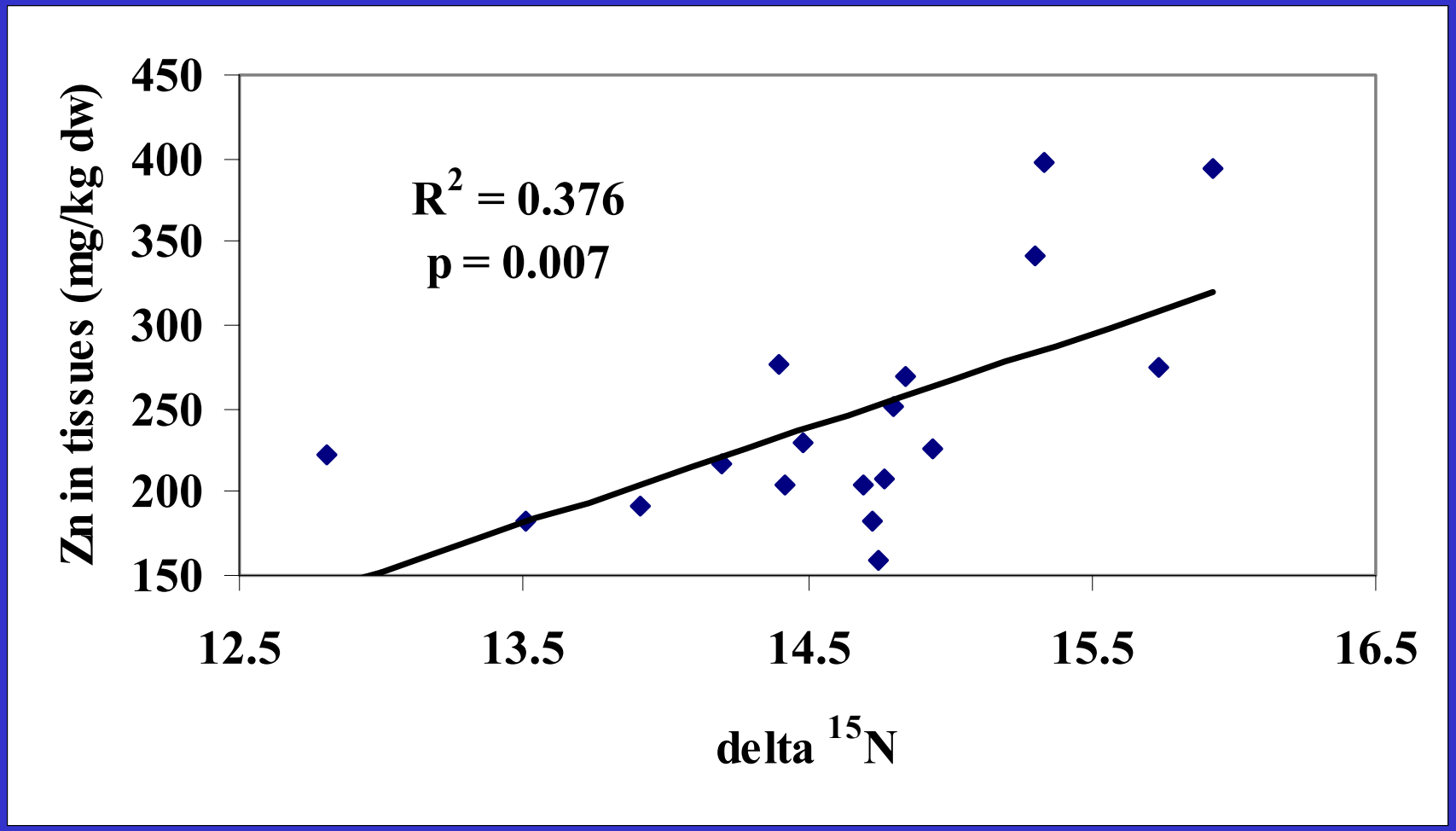
Interspecific variation at MSD



Hypothesis:

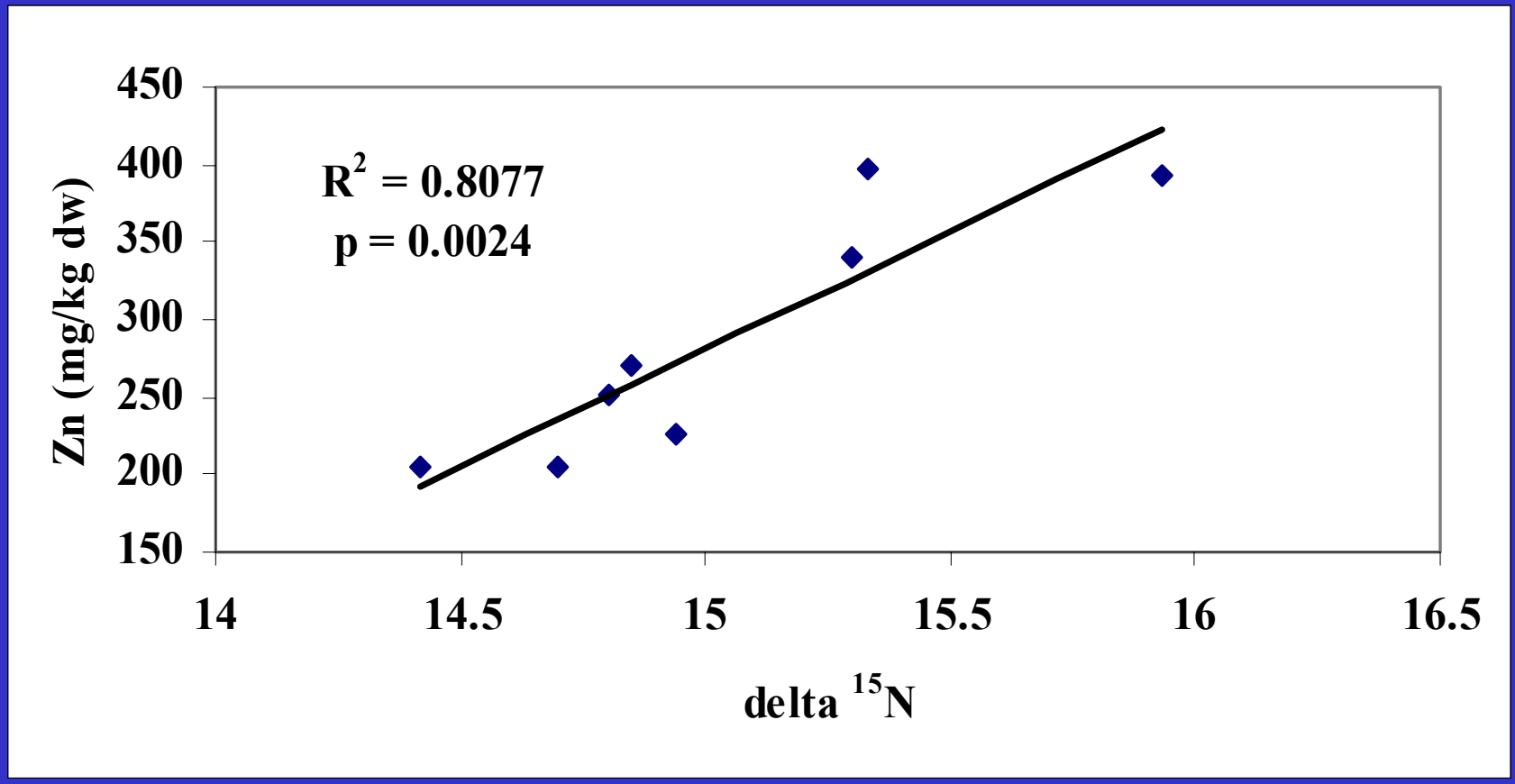
Species vary in $\delta^{15}N$, and therefore ingestion rate, assimilation, and/or depuration of nitrogen (food, possibly contaminants?)

MSD
Zn vs. ^{15}N enrichment (all three species)



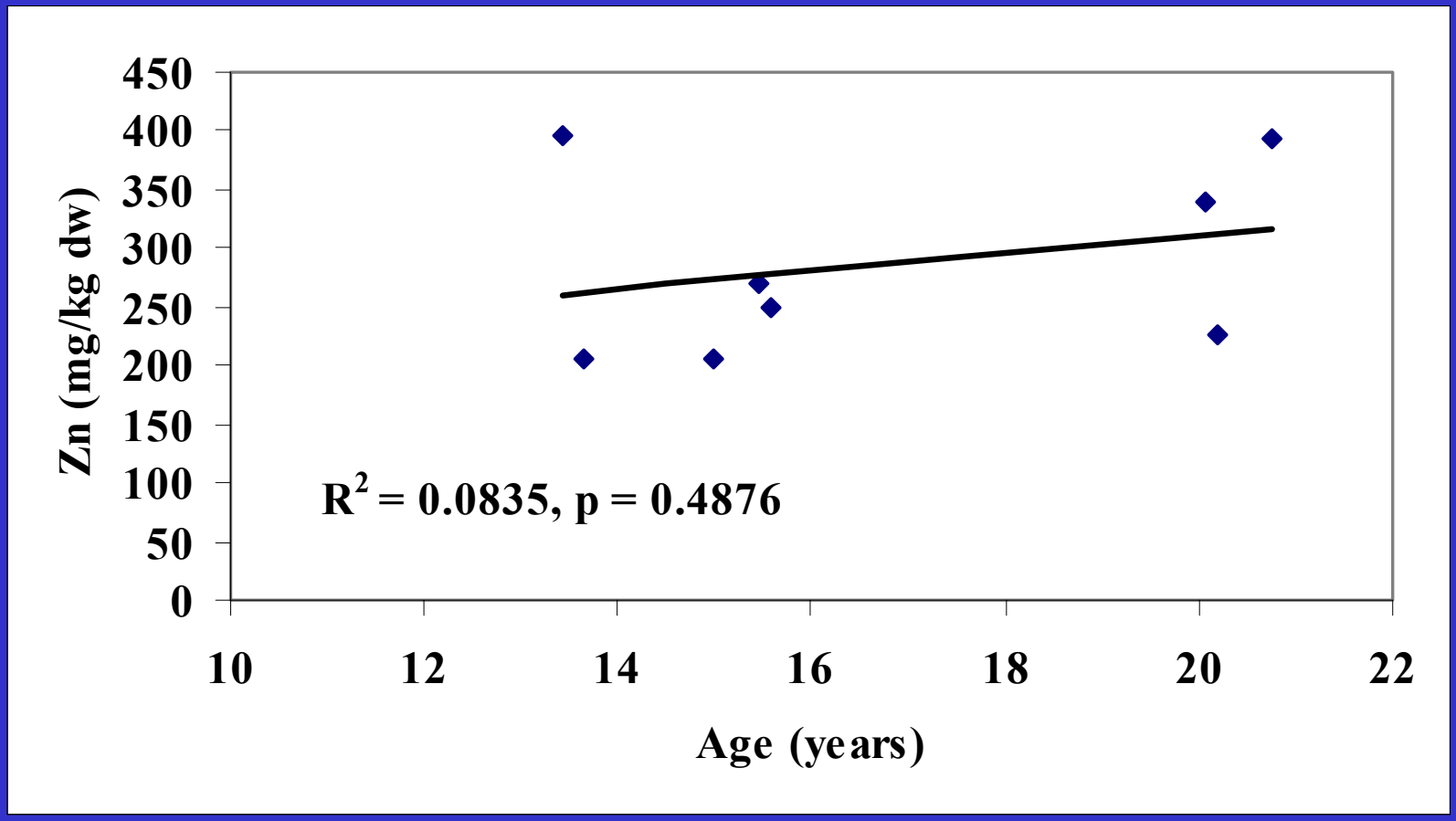
Differences in feeding/assimilation characteristics may result in differences in Zn accumulation.

MSD
Zn vs. ^{15}N enrichment (*Amblema plicata* only)



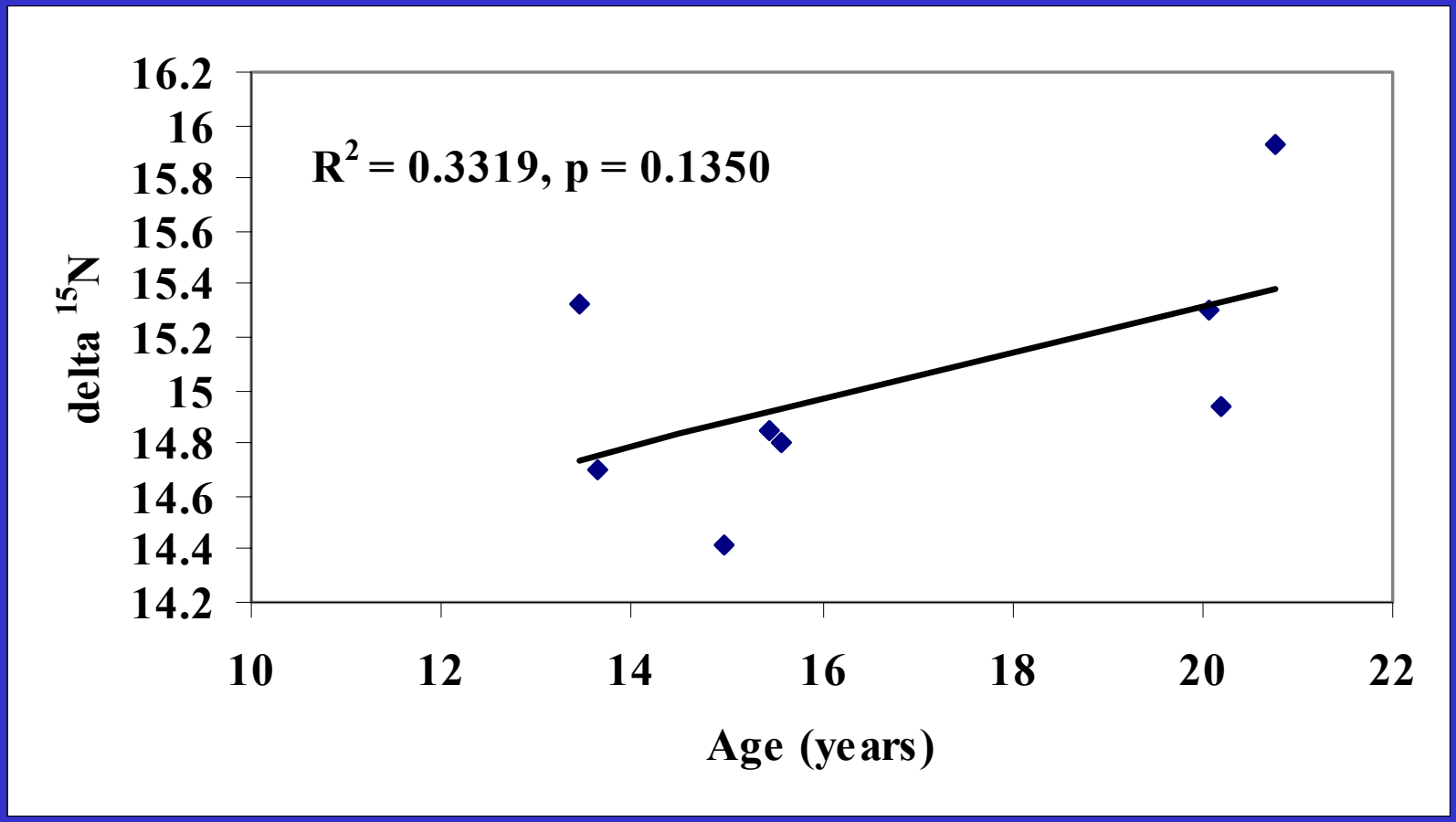
Differences in feeding/assimilation characteristics may result in differences in Zn accumulation.

MSD
Zn vs. Age (*Amblema plicata* only)



MSD

Age vs. ^{15}N enrichment (*Amblema plicata* only)



Conclusions

Many metal concentrations in *A. plicata* tissues are greater at Mississippi River downstream of the confluence (source or bioavailability differences?).

Se, Cu, and Zn concentrations in *A. plicata* were near published thresholds for effects to either mussels or their consumers.

Differences in some metal concentrations at MSD possibly a function of exposure time (organism age) or differences in feeding or assimilation rates or characteristics?

Future Work

Investigate contaminant sources and bioavailability issues (sediment, water characteristics, etc.) in the three rivers confluence area.

Investigate more sensitive measures of mussel stress (biomarkers such as DNA strand breakage, MT induction, etc.) to determine effects of Cu, Se, Zn.

Investigate species specific filtration/assimilation rates and effects on $\delta^{15}N$ and contaminant uptake.

Funding & Acknowledgements

The National Great Rivers Research and Education Center

Loretta Skowron, ISWS

John Tucker, INHS

Danny Brown, MODOC

Jon Talbott, WMRC

UC Davis Stable Isotope Facility